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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/713,626
Filing Date: November 13, 2003
Appellant(s): BENSON ET AL.

Chen Liang
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed December 26, 2006 appealing from the Office action mailed July 26, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,608,371	**Kurashima et al.**	**8-2003**
6,525,413	**Cloud et al.**	**2-2003**

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 9-17 and 19-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurashima et al. (US 6,608,371), hereinafter Kurashima in view of Cloud et al. (US 6,525,413), hereinafter Cloud.

Regarding claims 9 and 21, Fig. 4A of Kurashima shows a microfeature workpiece, comprising:

a plurality of first dies [13; Fig. 7 and col. 15, lines 30-34], wherein individual first dies have a first integrated circuit and; and

a plurality of first conductive mating structures [14, 16; protruding electrode], the first conductive mating structures projecting away from the dies and having openings [24] to receive and interconnect with corresponding complementary second conductive mating structures [32] on second dies [11; Fig. 7 and col. 15, lines 30-34] which are to be mounted to corresponding first dies.

Fig. 4A of Kurashima shows most aspect of the instant invention except a plurality of bond pads electrically coupled to the first integrated circuit and the mating structures proximate to the bond pads. Fig. 3 of Cloud shows a stacked semiconductor device [10, 20] wherein a plurality of pads [14, 16] electrically coupled to the integrated circuit and the mating structures proximate to the pads.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teachings of Cloud into the device of Kurashima in order to have a plurality of bond pads electrically coupled to the first integrated circuit to carry the signals to the mounting board.

Regarding claims 10 and 22, Fig. 3 of Cloud shows that the first conductive mating structures have generally circular configurations.

Regarding claim 11, Fig. 4A of Kurashima shows that the first conductive mating structures have generally triangular configurations.

Regarding claim 12, the combined teachings of Kurashima and Cloud fail to teach that "the first conductive mating structures have generally rectangular configurations." However, it would have been obvious matter of accommodating desired specification since such a modification would have involved a mere change in the shape of a component. A change in shape is generally recognized as being within the level of ordinary skill in the art. *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Regarding claims 13 and 23, Fig. 4A of Kurashima shows that the first conductive mating structures include an aperture configured to receive at least a portion of one of the second conductive mating structures.

Regarding claims 14 and 24, Fig. 4A of Kurashima shows that the first conductive mating structures have male configurations.

Regarding claim 15, Fig. 4A of Kurashima shows that the first conductive mating structures have female configurations.

Regarding claim 16, Fig. 3 of Cloud shows that the first conductive mating structures comprise solder (col. 6, lines 61-63).

Regarding claim 17, Fig. 3 of Cloud shows that the first dies include a first side and a second side opposite the first side; the first pads comprise a plurality of bond-pads on and/or in the first side of the first dies; and the first conductive mating structures are coupled to the bond-pads on the first side of the first dies (col. 6, lines 38-44).

Regarding claim 19, Fig. 7 of Kurashima shows the first dies include a third die, and it would have been obvious that the combined teachings of Kurashima and Cloud show the third die including a third pad adjacent to the first pad on the first die since the first die and the third die are adjacent to each other.

The combined teachings of Kurashima and Cloud fail to teach that "third pads are spaced apart from each other by a distance of less than approximately 100 microns." However, it would have been obvious to one of ordinary skill in the art at the time of the invention made to have third pads spaced apart from each other by a distance of less than approximately 100 microns for a compact packaging, since it would have been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only in routine skill in the art. *In re Aller,* 105 USPQ 233.

Regarding claim 20, Fig. 3 of Cloud shows that the first conductive mating structures are formed on corresponding first pads.

(10) Response to Argument

A. Grouping of Claims

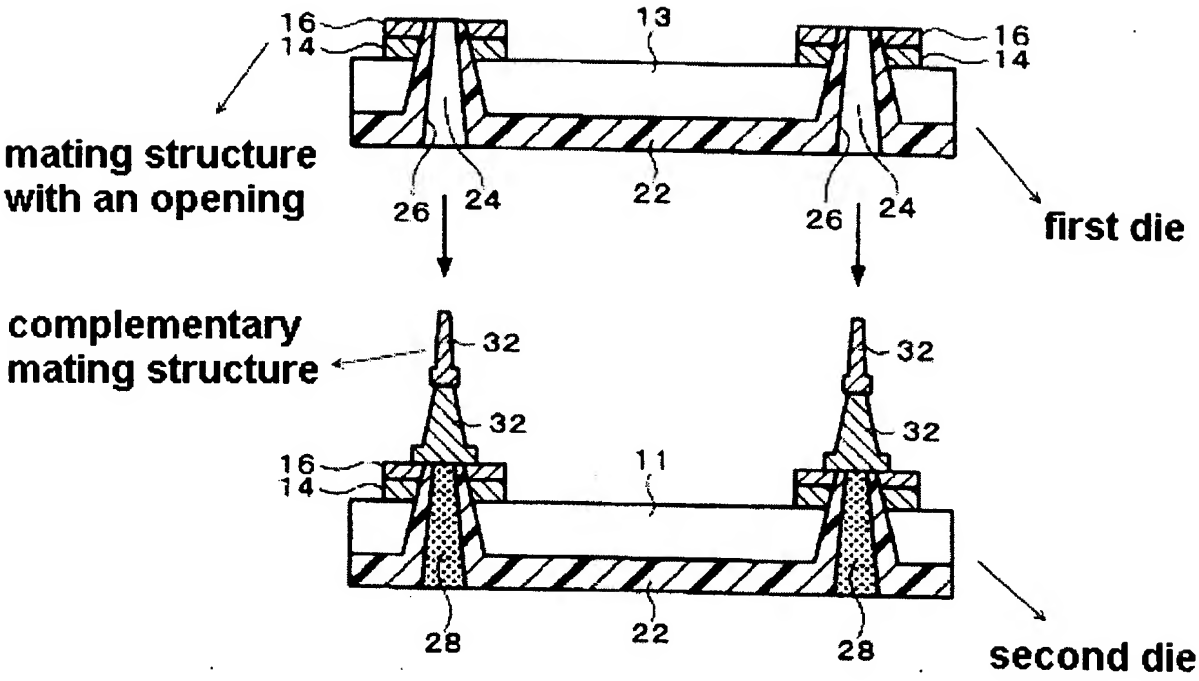
On page 7 of the Appeal Brief, Appellant argues that Group I of claims 9-17, 19, and 20 and Group II of claims 21-24 are separately patentable. Examine disagrees since the appellant's explanation on why Group I is separately patentable from Group II is not persuasive. Appellant explains that "Claims 9-17, 19, and 20 recite a microfeature workpiece having a plurality of first conductive mating structures projecting away from the first dies and having openings configured to receive and interconnect with corresponding complementary second conductive mating structures on second dies which are to be mounted to corresponding first dies," and "Claims 21-24 recite a microelectronic die having an integrated circuit, a plurality of bond-pads electrically coupled to the integrated circuit, and a plurality of first conductive mating structures projecting away from the die directly from corresponding bond-pads." It is, however, pointed out that both of the independent claims 9 and 21 recite a first die having mating structures projecting away from the first die and having openings configured to receive complementary second conductive mating structures on second die to which is to be mounted. A comparison of the two claims 9 and 21 shows that the sole difference lies in the fact that claim 9 recites a plurality of first dies and a plurality of second dies wherein the individual first and second dies are mounted in the same way as recited in claim 21. Note that claim 21 recites how the individual first and second dies are mounted. Therefore, it is deemed that Group I of claims 9-17, 19, and 20 and Group II of claims 21-24 are not separately patentable.

B. Patentability of Group I - Claims 9-17, 19, and 20

Starting on page 7 to page 10, Appellant details the Kurashima's method for manufacturing a semiconductor device. It is, however, pointed out that this portion of the argument is not relevant to the device claims of the instant invention.

On page 11 of the appeal brief, Appellant argues that "The combined teachings of Kurashima and Cloud fail to teach or suggest several features of claim 9. For example, the combination of these references does not teach or suggest a microfeature workpiece including, *inter alia*, a plurality of 'first conductive mating structures projecting away from the first dies and having openings configured to receive and interconnect with corresponding complementary second conductive mating structures on second dies' of claim 9." Examiner disagrees. Figure 4A of Kurashima, reproduced below, shows explicitly that first conductive mating structures 14, 16 (electrode) projecting away from the first dies (top die) and having openings 24 configured to receive and interconnect with corresponding complementary second conductive mating structures 32 on the second dies (bottom die). And note that being an electrode indicates that it is conductive. Furthermore, Kurashima discloses that a plurality of electrodes 14 are aluminum with the metal plating 16 (col. 6, lines 23-48). In addition, Figure 3 of the instant invention is reproduced below to show that mating structures of the first die (top die) in Figure 4A of Kurashima is substantially identical to the ones shown in the instant invention. That is, Figure 3 of the instant invention shows a mating structure 244 projecting away from the first die with an opening 255 while Kurashima shows a mating structure (14, 16; electrode) protruding from the first die with an opening 24.

FIG. 4A


16
14
13
16
14
mating structure
with an opening
26
24
22
26
24
first die
complementary
mating structure
32
32
32
32
16
14
11
28
22
28
second die

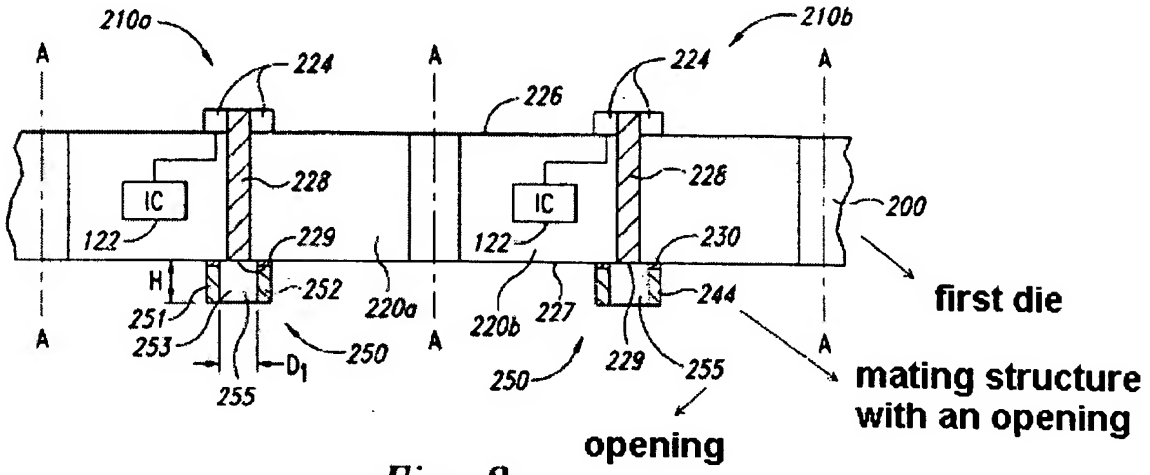

210a
210b
A
224
224
226
228
228
IC
IC
122
122
229
230
200
H
252
244
251
253
250
220a
220b
227
D1
255
250
229
255
first die
mating structure
with an opening
opening

Fig. 3

Continuing on page 11 of the appeal brief Appellant argues "In the Final Office Action mailed July 26, 2006, the Examiner alleged that Kurashima's second through holes 24 correspond to 'a plurality of first conductive mating structures' of claim 9. (Office Action, July 26, 2006, page 2). Kurashima's second through holes 24, however, are voids through the insulating material 22 that electrically isolates the conductive member 28 from the chip 10. The second through holes 24 are accordingly dielectric instead of being conductive." Firstly, it is pointed out that "a plurality of first conductive mating structures" was intended to designate protruding conductive electrodes 14, 16 with an opening 24, and this aspect is clearly shown in Figure 4 of Kurashima. And note that the opening 24 is extended through the electrode 14, 16. Secondly, it is confusing to understand the Appellant's argument that "Kurashima's second through holes 24, however, are voids through the insulating material 22 that electrically isolates the conductive member 28 from the chip 10. The second through holes 24 are accordingly dielectric instead of being conductive," since Kurashima does not disclose that the second through holes 24 are dielectric. Rather, Kurashima discloses that in the first die (top die), the through hole 24 is an opening to receive the mating structure 32 of the second die (bottom die), and in the second die (bottom die), the opening 24 is filled with the conductive material 28. Figures 4A and 4B of Kurashima are reproduced below to show this aspect in detail. As shown in Figure 4A, the openings 24 of the first die are configured to receive the bumps 32's that have the shape complementary to the openings. And note that Figure 4B is a configuration once the first die is mounted onto the second die, therefore, the opening in the protruding electrode and the top bump 32 are complementary to each other.

FIG. 4A

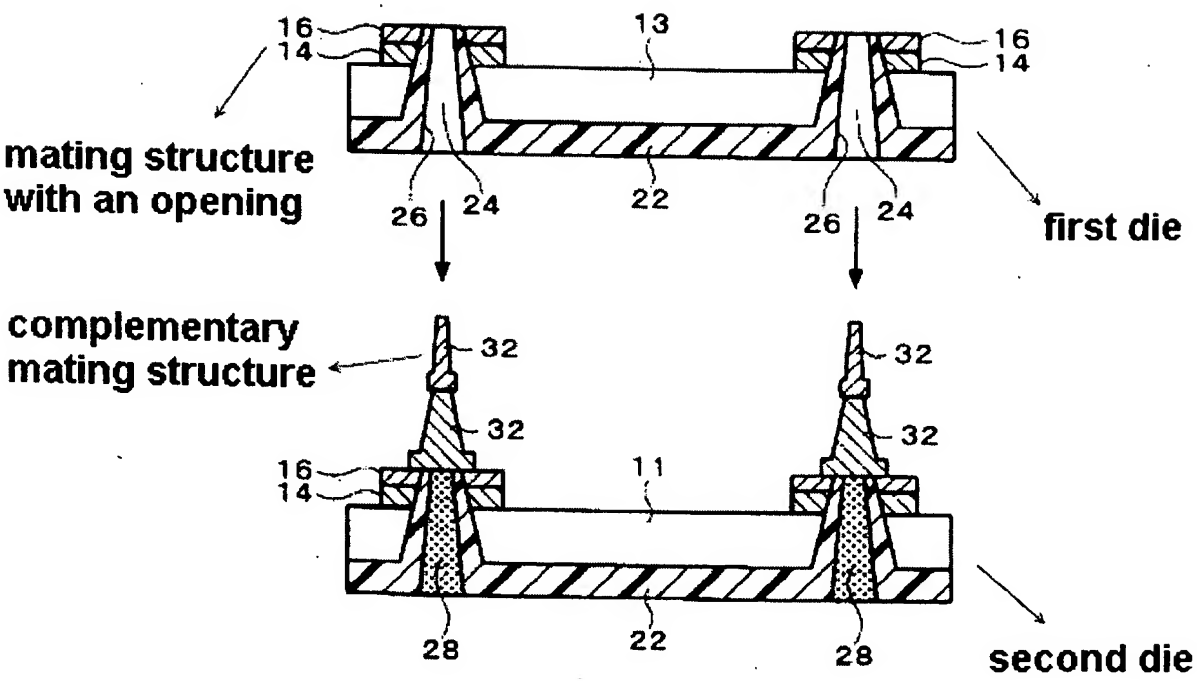
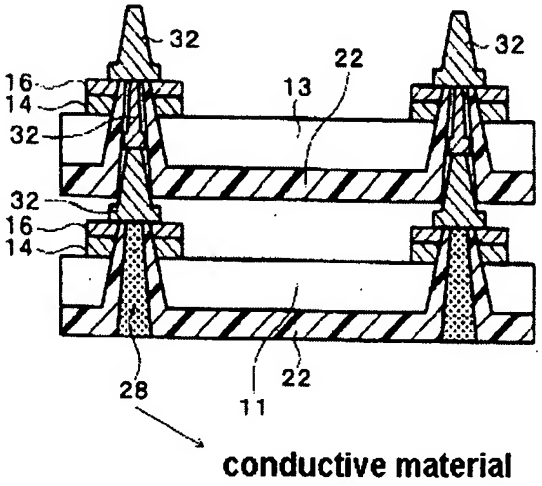

16
14
13
16
14
mating structure
with an opening
26
24
22
26
24
first die
complementary
mating structure
32
32
32
32
16
14
11
28
22
28
second die

FIG. 4B


32
32
22
16
14
13
32
32
16
14
28
22
11
conductive material

Still on page 11, Appellant agues that "In the Advisory Action mailed November 28, 2006, the Examiner responds to this argument by alleging that Kurashima's conductive material 28 in the second through holes 24 makes the second through holes 24 conductive. (Advisory Action, Nov. 28, 2006, page 2). This statement is incorrect because the 'hole' does not change, but rather the material that fills the hole is conductive. Moreover, in this embodiment of Kurashima, the conductive material 28 completely fills the second through holes 24 such that there is no conductive structure that has an opening in Kurashima. As a result, there is no 'conductive mating structure' with 'openings configured to receive corresponding complementary second mating structures' in Kurashima. Kurashima's second through holes 24 also do not project away from the semiconductor dies because the second through holes 24 do not extend beyond the edge of the semiconductor dies. Accordingly, neither embodiment of Kurashima discloses or suggests mating structures that are (1) conductive, (2) project away from the first dies, and (3) have an opening to receive corresponding complementary second mating structures." However, this argument is not persuasive. As discussed above in detail, it is pointed out that "conductive mating structure with an opening" was intended to designate conductive electrodes 14, 16 with an opening 24 that extends through the electrodes. With this understanding, Figure 4A of Kurashima clearly shows the mating structure, that is, a protruding electrode 14, 16 with an opening 24 in the top die (first die) and the bumps 32's in the bottom die (second die). And Figure 4B shows that the bumps are fitted into the openings, indicating that they are mating structures with the complementary shapes. Further, Kurashima discloses that the electrodes and the bumps are conductive (col. 6, lines 23-48 and col. 12, lines 41-42). Therefore, Figure 4A of Kurashima shows mating structures 14, 16 that are conductive (col. 6, lines 23-48), project away

from the first dies (through being protruding electrodes), and have an opening 24 to receive corresponding complementary second mating structures 32's, in particular, top bump 32.

Spanning page 11 to page 12, Appellant agues that "Cloud also fails to disclose or suggest such a combination. For example, assuming, for the sake of argument, that Cloud's conductive structure 28 corresponds at least in part to the first mating structures of claim 9, Cloud's conductive structure 28 does not have 'openings configured to receive corresponding complementary second mating structures'. Instead, the conductive structure 28 are configured to be placed in a plurality of recesses in a semiconductor die. Moreover, assuming, that Cloud's recesses having the bond pads 14 correspond at least in part to the first mating structure claim 9, the recesses do not project away from the semiconductor die. Accordingly, Cloud fails to fill the void left by Kurashima. Therefore, the combined teachings of Kurashima and Cloud fail to teach or suggest all the features of claim 9." However, the examiner disagrees. Before responding to this argument, it is pointed out that Cloud is referred merely to complement the limitation that the projected mating structure is formed near the pad which is electrically coupled to the integrated circuit. And, this limitation can be understood that the mating structure has an electrically-coupled pad portion. Figure 3 of Cloud discloses that mating structures include the pads 14, 24 that are electrically coupled to the integrated circuit (col. 6, lines 39-44). Therefore, the combined teachings of Kurashima and Cloud suggest all the limitations recited in claim 9.

On page 12, Appellant further agues that "Moreover, a person skilled in the art would not modify Kurashima's device to have the conductive mating structures with openings of claim 9 because Kurashima teaches away from replacing the insulating material 22 with a conductive material." This argument is not persuasive since, as discussed above in length, Kurashima shows

that the conductive mating structures (protruding electrodes 14, 16) with openings 24. Therefore, it is pointed out that the Appellant's continuing argument that "Accordingly, one skilled in the art would not modify Kurashima's device to have a conductive material instead of the insulating material 22 as suggested by the Examiner." is rather confusing since the argument is not directed to address the Kurashima's disclosure and/or teachings.

Continuing on page 12, Appellant agues that "Accordingly, the current rejection of claim 9 does not comply with Section 103(a) because (1) even if combined, the combined teachings of Kurashima and Cloud still do not teach or suggest all the features of the pending claims; and (2) one of ordinary skill in the art would not modify Kurashima's teachings as suggested by the Examiner because such a modification would result in an inoperable device." Examiner disagrees since as discussed above, the combination of Kurashima and Cloud teaches and/or suggests all the limitations of the pending claims. And it is further pointed out that the argument of " ... such a modification would result in an inoperable device" is purely speculative without supporting basis.

C. Patentability of Group II - Claims 21-24

On page 13, Appellant agues that "This combination of references also fails to disclose or suggest that such mating structures project away from the die directly from the bond pads. In both Kurashima and Cloud, the conductive features projecting away from bond pads are solid without openings." Examiner disagrees. Before addressing to this argument, it is pointed out that the instant invention does not recite that "mating structures project away from the die directly from the bond pads." Rather, claim 21 recites that "a plurality of first conductive

mating structures on corresponding bond-pads, the first conductive mating structures projecting away form the die directly from corresponding bond-pads." Thus, this limitation implies that conductive mating structures are formed on the bond-pad since it recites the conductive mating structures *on corresponding bond-pads and* projecting away *directly from corresponding bond-pads* (emphasis added). And the Cloud reference is introduced to show that bond pads 14, 24 are formed on the bottom of the conductive mating structures. Therefore, the combination of Kurashima and Cloud shows that mating structures on the corresponding bond pads project away from the die directly from the corresponding bond pads.

On page 13, Appellant further agues that "Moreover, a person skilled in the art would not modify the conductive features in Kurashima and Cloud to have openings because the resulting electrical connections may have voids. Accordingly, the Section 103(a) rejection of claim 21 is improper and should be reversed for at least the reasons discussed above." Examiner disagrees. As repeatedly stated above, Kurashima shows the conductive features/the conductive mating structures with an opening, therefore, there is no reason to modify the Kurashima's conductive features to have an opening.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Junghwa Im
August 2, 2007

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